

10/519023
DT01 Rec'd PCT/PT 22 DEC 2004IN THE CLAIMS

Please amend the claims as follows:

1. (Previously Presented) Apparatus for forming a hole in a region of the heart muscle wall of
5 a patient undergoing myocardial revascularization comprising:
 means for removing tissue from the region to form the hole;
 a light source that illuminates the region with non-ablating light that generates
photoacoustic waves therein;
 at least one acoustic sensor that generates signals responsive to the photoacoustic
10 waves; and
 a controller that receives the signals and processes them to determine a depth for the
hole.
2. (Original) Apparatus according to claim 1 wherein the light source illuminates the region
15 with at least one pulse of light at a wavelength at which light is absorbed by a substance in the
region whose concentration can be used to assess a degree of ischemia in the region and
wherein the controller processes the signals provided by the at least one acoustic sensor to
assay the substance.
- 20 3.-5. (Cancelled)
6. (Currently Amended) Apparatus according to ~~any of claims 1-5~~ claim 1 wherein the light
source illuminates the region with at least one pulse of light at a wavelength at which light is
absorbed by water and determines temperature of the region responsive to the signals.
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7. (Previously Presented) Apparatus according to claim 6 and comprising a heat pump that
generates a temperature difference between tissue in the region and an ambient temperature of
the heart wall and wherein the controller thereafter determines temperature of the tissue as a
function of time to assess a degree of ischemia in the region.
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8. (Currently Amended) Apparatus according to ~~any of the preceding claims~~ claim 1 wherein
the light source illuminates the region with at least one light pulse prior to forming the hole
and the controller processes the signals to determine a thickness of the heart wall in the
region.

9. (Previously Presented) Apparatus according to claim 1 wherein the controller controls the means for removing tissue from the region responsive to the determined depth and stops formation of the hole by the means for removing tissue when a desired hole depth is reached.

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10. (Currently Amended) Apparatus according to ~~any of the preceding claims~~ claim 1 wherein the hole is formed in a first surface of the heart wall and deepened towards a second surface of the heart wall and ~~and~~ the controller uses the signals generated by the at least one acoustic sensor to determine a thickness of the heart muscle wall between the bottom of the hole and the second surface.

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11.-12. (Cancelled)

13. (Currently Amended) Apparatus according to ~~any of claims 10-12~~ claim 10 wherein the controller controls the means for removing tissue from the region responsive to the determined thickness and stops formation of the hole by the means for removing tissue when a desired thickness is reached.

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14. (Currently Amended) Apparatus according to claim 1 ~~any of the preceding claims~~ wherein the means for removing tissue comprises a source of ablative energy having an output port from which the ablative energy source provides energy for removing heart tissue by ablation.

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15. (Previously Presented) Apparatus according to claim 14 wherein the source of ablative energy illuminates the region with at least one pulse of ablative energy to form the hole.

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16. (Previously Presented) Apparatus according to claim 15 wherein the at least one ablative pulse generates an acoustic shock wave in the region responsive to which the at least one acoustic sensor generates signals that are transmitted to the controller and wherein the controller processes the signals to determine at least one characteristic of the shock waves.

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17. (Previously Presented) Apparatus according to claim 16 wherein the controller controls at least one characteristic of the at least one ablative pulse responsive to the determined at least one characteristic of the shock wave.

18.- 19. (Cancelled)

20. (Currently Amended) Apparatus according to ~~any of claims 15-18~~claim 15 wherein the pulse generates an acoustic shock wave and wherein an acoustic sensor of the at least one
5 acoustic sensor generates signals responsive to reflections of acoustic energy from the shock wave which the controller processes to determine a characteristic of the region.

21. (Previously Presented) Apparatus according to claim 20 wherein the characteristic
10 comprises a depth of the hole.

22. (Currently Amended) Apparatus according to claim 20 ~~or claim 21~~ wherein the characteristic comprises a thickness of the heart muscle wall between the bottom of the hole and a surface of the wall.

15 23. (Currently Amended) Apparatus according to ~~any of claims 15-22~~claim 15 wherein the at least one acoustic sensor generates signals responsive to an acoustic shock wave generated by the at least one ablative pulse and the controller processes the signals to determine location of the source of the shock waves.

20 24. (Cancelled)

25. (Currently Amended) Apparatus according to ~~any of claims 14-23~~claim 14 wherein the light source illuminates the region with at least one pulse of light after onset of ablation and the controller uses signals generated by the at least one acoustic sensor responsive to
25 photoacoustic waves to assess damage to tissue in the region of the hole caused by ablation.

26. (Previously Presented) Apparatus according to claim 25 wherein the wavelength of the at least one light pulse is determined so as to increase a difference in the photoacoustic response of damaged tissue relative to undamaged tissue.

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27. - 28. (Cancelled)

29. (Currently Amended) Apparatus according to ~~any of claims 25-28~~claim 25 wherein the controller controls at least one characteristic of the ablative pulses responsive to the determined damage.

5 30. (Currently Amended) Apparatus according to ~~any of claims 14-29~~claim 14 wherein the controller processes the signals from the at least one acoustic sensor to determine a distance of the ablative energy output port to the bottom of the hole.

31. – 33. (Cancelled)

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34. (Currently Amended) Apparatus according to ~~any of claims 14-33~~claim 14 and comprising a catheter having a drill end that is positioned in a neighborhood of or in contact with the region in order to form the hole and wherein the optical output aperture, the ablative energy output port and an acoustic sensor of the at least one acoustic sensor are mounted
15 inside the catheter in a neighborhood of the drill end.

35. (Currently Amended) Apparatus according to ~~any of claims 14-34~~claim 14 wherein the controller processes signals that it receives from the at least one acoustic sensor to determine a location of the ablative energy output port.

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36. (Currently Amended) Apparatus according to ~~any of claims 1-14~~claim 1 and comprising a catheter having a drill end that is positioned in a neighborhood of or in contact with the region in order to form the hole and wherein the optical output aperture and an acoustic sensor of the at least one acoustic sensor are mounted inside the catheter in a neighborhood of the drill
25 end.

37. – 38. (Cancelled)

39. (Currently Amended) Apparatus according to ~~any of the preceding claims~~claim 1 wherein
30 the at least one acoustic sensor comprises an external acoustic sensor coupled to the patient's skin.

40. (Cancelled)